

$$\star \frac{d}{dx} (\sin x) = \cos x$$

$$\star \frac{d}{dx} (\cos x) = -\sin x$$

$$\star \frac{d}{dx} (\tan x) = \sec^2 x$$

$$\frac{d}{dx} (\cot x) = -\csc^2 x$$

$$\star \frac{d}{dx} (\sec x) = \sec x \tan x$$

$$\frac{d}{dx} (\csc x) = -\csc x \cot x$$


$$\begin{aligned} \frac{d}{dx} \left(\frac{\sin x}{\cos x} \right) &= \\ \frac{(\overset{f'}{(\cos x)})(\overset{g}{\sin x}) - (\overset{f}{\cos x})(\overset{g'}{(-\sin x)})}{\cos^2 x} &= \\ = \frac{\cos^2 x + \sin^2 x}{\cos^2 x} &= \\ = \frac{1}{\cos^2 x} = \sec^2 x \end{aligned}$$

$$\begin{aligned}
 \frac{d}{dx}(\sin x) &= \lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin x}{h} \\
 &= \lim_{h \rightarrow 0} \frac{(\sin x \cosh + \sin h \cos x) - \sin x}{h} \\
 &= \lim_{h \rightarrow 0} \frac{(\sin x)(\cosh - 1) + (\sin h)(\cos x)}{h} \\
 &= \sin x \left[\lim_{h \rightarrow 0} \left(\frac{\cosh - 1}{h} \right) \right] + \cos x \left[\lim_{h \rightarrow 0} \left(\frac{\sin h}{h} \right) \right] \\
 &\quad \swarrow \quad \searrow \\
 &\quad \sin x (-0) \quad \quad \quad 1
 \end{aligned}$$

3.4 examples

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$$\star \frac{d}{dx} (\sin x) = \cos x$$

$$\frac{d}{dx} (\cot x) = -\csc^2 x$$


$$\star \frac{d}{dx} (\cos x) = -\sin x$$

$$\star \frac{d}{dx} (\sec x) = \sec x \tan x$$

$$\star \frac{d}{dx} (\tan x) = \frac{d}{dx} \left(\frac{\sin x}{\cos x} \right) = \sec^2 x$$

$$\frac{d}{dx} (\csc x) = -\csc x \cot x$$

$$\frac{d}{dx} \left(\frac{1}{\tan x} \right) = \dots$$

$$= \frac{d}{dx} \left(\frac{\cos x}{\sin x} \right) =$$

$$\frac{d}{dx}(\sin x) = \lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin(x)}{h}$$

$\sin x \cosh - \sin x = \sin x (\cosh - 1)$



$$= \lim_{h \rightarrow 0} \frac{(\sin x \cosh + \sinh \cos x) - \sin x}{h}$$

$$= \lim_{h \rightarrow 0} \frac{(\sin x)(\cosh - 1) + (\sinh)(\cos x)}{h}$$

$$= (\sin x) \lim_{h \rightarrow 0} \frac{\cosh - 1}{h} + \cos x \lim_{h \rightarrow 0} \frac{\sinh}{h}$$

-0
= cos x
1

3.4 examples

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